JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOL. 15 DECEMBER 4, 1925 No. 20

GEOPHYSICS.—*Isostasy in the southern Pacific.* WILLIAM BOWIE, U. S. Coast and Geodetic Survey.

The word *isostasy* was first used at a meeting of the Philosophical Society of Washington on April 27, 1889, in an address[1] by Major Clarence E. Dutton, a member of the U. S. Geological Survey, when he definitely formulated the fundamental principles underlying isostasy.

The progress of the isostatic investigations carried on by the U. S. Coast and Geodetic Survey during the past twenty-five years, by which the idea has been developed into a scientific principle, has been set forth in a number of papers delivered before the society. It was, therefore, very fitting that the officials of the society should have made a grant to be used in making the isostatic reduction of several gravity stations. The grant in question was made to the writer in the early part of 1925.

For the reduction, five island stations in the southern Pacific were selected. This choice was deemed advisable because there had been no systematic test of isostasy in the southern hemisphere, and it was especially desirable to add to the meagre knowledge we had of the isostatic condition of the Earth's crust under the oceans.

The determinations of gravity at the selected stations were made by observers of the navy of Austria-Hungary in 1893 and 1896. Modern instruments and methods were employed by them, but, owing to the short time available while the vessels were in port, the pendulums were swung for only a few hours at a station. The inaccuracy of the gravity values may, therefore, be as great as 0.010 dyne or centimeter per second per second. This uncertainty is much greater than that of a standard gravity station for which the value of gravity has a probable error seldom exceeding 0.002 dyne. Neverthe-

[1] Bull. Phil. Soc. Washington 11: 51–64. 1899; reprinted in Journ. Washington Acad. Sci. 15: 359–369. 1925.

less, the island stations selected have gravity values sufficiently reliable to test the local isostasy.

The data for the stations were taken from the report of the International Geodetic Association entitled, *Comptes Rendus de l'Associa-*

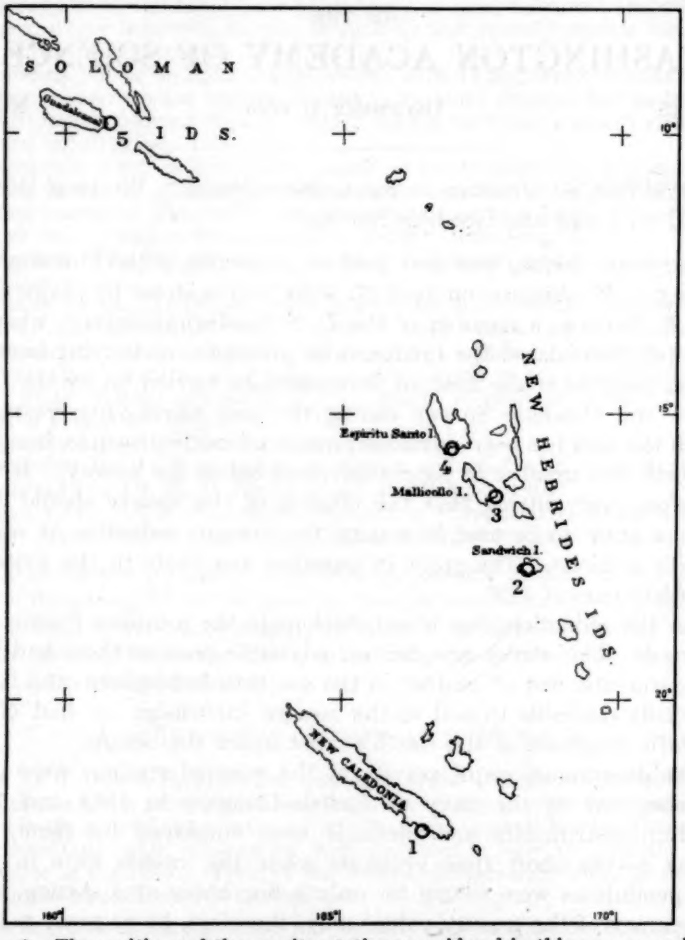

Fig. 1.—The positions of the gravity stations considered in this paper are shown above by circles. The numbers correspond to those in the table of data.

tion Géodésique Internationale (3. 1909). The isostatic reductions under the grant by the Philosophical Society of Washington were made under the immediate direction of C. H. Swick, Mathematician of the U. S. Coast and Geodetic Survey.

TABLE 1.—Essential Data for Stations

Station	Latitude ϕ	Longitude λ (East)	Theoretical value of gravity at sea level below station γ_0	Elev. meters	Corr. for elev.	Correction for topography and compensation	Computed gravity at station (g_c)	Observed gravity at station (g)	Isostatic anomaly $g-g_c$	Free air anomaly
Compensation depth 113.7 km.										
1. Numea	−22° 16.6′	166° 27.8′	978.780	2	−0.001	+0.077	978.856	978.877	+0.021	
2. Vila (Sandwich)	−17 45.0	168 19.0	978.518	3	−0.001	+0.121	978.638	978.637	−0.001	
3. Port Sandwich	−16 26.2	167 47.0	978.452	3	−0.001	+0.106	978.557	978.577	+0.020	
4. Tangoa	−15 36.2	167 00.1	978.412	3	−0.001	+0.097	978.508	978.557	+0.049	
5. Marau Sd	−9 49.1	160 48.5	978.188	3	−0.001	+0.099	978.286	978.345	+0.059	
Mean with regard to sign									+0.030	
Mean without regard to sign									0.030	
Compensation depth 96 km.										
1. Numea	−22° 16.6′	166° 27.8′	978.780	2	−0.001	+0.073	978.852	978.877	+0.025	+0.098
2. Vila (Sandwich)	−17 45.0	168 19.0	978.518	3	−0.001	+0.117	978.634	978.637	+0.003	+0.120
3. Port Sandwich	−16 26.2	167 47.0	978.452	3	−0.001	+0.103	978.554	978.577	+0.023	+0.126
4. Tangoa	−15 36.2	167 00.1	978.412	3	−0.001	+0.093	978.504	978.557	+0.053	+0.146
5. Marau Sd	−9 49.1	160 48.5	978.188	3	−0.001	+0.097	978.284	978.345	+0.061	+0.158
Mean with regard to sign									+0.033	+0 130
Mean without regard to sign									0.033	0.130

In Table 1 are given the essential data for the stations, including the anomalies by the Free Air and the Isostatic reductions.

In the Free Air method of reducing gravity stations, the only correction applied to the value of gravity as computed for sea level at the latitude of the station is for the elevation of the station above the level of the sea. For the island stations the elevation correction is very small because the stations are located at places little above the sea. The isostatic reductions were made by the method described in detail in special publications Nos. 10 and 40 of the U. S. Coast and Geodetic Survey.

For some years the depth of 113.7 kilometers was used in the computation of the effect of the isostatic compensation but in special publication No. 40, 96 kilometers was derived as the most probable depth of compensation. The reduction of the five island stations was made for both values, as shown in the table.

For many years students of the Earth have tried to explain the great difference between the computed and the observed values of gravity at island stations. The Free Air reduction left the observed value much greater than the theoretical one. No explanation prior to the establishment of the theory of isostasy seemed to meet with favor except the one that the crust under the oceans was far heavier than that under the continents. This idea was strongly favored by many geologists, as indicated in geological literature by its application to major problems.

The first test of isostasy, under the oceans, was made by the late Dr. John F. Hayford and the author when the isostatic reduction was made for six island gravity stations. The results are shown on page 81 of special publication No. 10 of the U. S. Coast and Geodetic Survey.[2] Stations were then purposely selected which had large differences between the observed and the theoretical values. Even those stations had their gravity anomalies very much reduced by the application of the isostatic method.

By reference to the preceding table, it will be seen that the anomalies by the Free Air method are large. The greatest anomaly is +0.158 while the smallest one is +0.098, with an average of +0.130.

The isostatic anomalies are, in each case, smaller than the Free Air ones. Since it is believed that the depth of compensation, 96 kilometers, is the most reliable one, the anomalies deduced by using that depth will be considered the true ones. As a matter of fact, they

[2] These results were later superseded by somewhat different values which are given in special publication No. 40, p. 57.

differ only 0.003 dyne on the average from those obtained with the depth of 113.7 kilometers.

One isostatic anomaly is only +0.003, very close to zero. Of the other four, two have anomalies of +0.023 and +0.025 which are only slightly larger than the average of 0.020 dyne for the stations of the United States. The other two anomalies are +0.053 and +0.061 which are nearly two and one-half times the average anomaly in the United States, but there are a number of anomalies in this country which are larger than they are.

If the crust under the island stations considered here were normal in density, the deficiency of mass in the space around them occupied by water would indicate the amount the crust was out of equilibrium. In such case the observed values of gravity would be smaller than the theoretical values by the negative effect of the deficient masses. But instead of the observed gravity being too small at each of the stations it is too great. This leads one to suspect that the crust below is much denser than normal. The isostatic reductions enable us to learn just how much above normal is the density of the crustal matter.

In making the isostatic reduction, the negative effect of the deficiency in density in the ocean waters was computed and also the effect of the isostatic compensation supposed to be equal in amount to the deficiency but, of course, of the opposite sign. The compensation was assumed to be distributed uniformly throughout the thickness of the crust down to a depth of 96 kilometers below sea level. Also the compensation was assumed to be directly below the topographic features, in this case the water of different depths and the small masses of the islands above sea level. The effect of the isostatic reduction was to account for the larger part of the differences between the observed and the theoretical values. The unaccounted-for difference was reduced from an average of +0.130 dyne to +0.033 dyne. This is a reduction of 75 per cent.

There are several explanations of the isostatic anomalies:

(1). That the crust below the stations is out of balance by an amount indicated by the anomalies. On an average this is equivalent to 825 feet of rock of a density of 2.7 of indefinite horizontal extent. Even if this were true, still we could say that isostasy obtains to a very marked degree.

(2). The depth of compensation may be greater, and should the depth used in the computations be increased, the anomalies may be greatly reduced. The change of nearly 18 kilometers only reduced the anomalies 0.003 dyne. Therefore, to bring the average anomaly with regard to sign to zero, by a change in depth, the depth would

have to be increased by about 200 kilometers, making the new depth about 300 kilometers. This depth seems to be most improbable. The difference in the behavior of crustal and subcrustal matter must be a function of pressure and of heat. Since the pressure at 96 kilometers below the sea level surface under the oceans and the land must be very close to equal, we have only the heat different. It is difficult to see how there could be very great heat differences at a depth of 96 kilometers under the sea and the continent. I think we should reject the greater depth of compensation explanation.

(3). Uncertainty in the values of gravity as observed. Earlier in this paper it is stated that the uncertainty is about 0.010 dyne. This is less than one-third the average anomaly. Even should the uncertainty be as much as that, it is likely that at some stations the error would be positive and at others negative. This explanation probably would account for some part of the isostatic anomalies.

(4). Densities of the materials in the pedestals, on which the islands rest, larger than those used in the computations. Should these densities be from 10 per cent to 15 per cent above normal, then the average anomaly, with regard to sign, could be reduced to about one-half of their present values. The islands are volcanic and it is probable that the density below them is greater than normal.

It may be concluded that the causes of the isostatic anomalies are probably due in part to errors in the observed gravity values, and to an excess of density of the material composing the island pedestals.

Five island gravity stations are not sufficient on which to base a definite conclusion regarding the isostatic condition of the Earth's crust under the oceans, but the evidence presented here is in close accord with evidence from land data and from those collected by Dr. F. A. Vening Meinesz on his submarine voyage from Holland to Java, when he determined the value of gravity at a number of places at sea.

BOTANY.—*Twelve new species of Valeriana from the Andes of South America.*[1] ELLSWORTH P. KILLIP, U. S. National Museum.

In the present paper twelve new Andean species of Valeriana are described. In nearly every case the specimens upon which these are based were taken to Europe last summer by the writer, and compared with material in the rich collections at Paris, Geneva, Berlin, and London.

[1] Published by permission of the Secretary of the Smithsonian Institution.

This difficult, widely distributed genus has been subdivided in various ways by Hoeck,[2] Graebner,[3] Briquet,[4] and others, numerous subgenera and several segregated genera having been proposed. A thorough revision based on collections in the United States as well as in Europe is greatly needed. It was not practicable for me in the time at my disposal to do more than make the comparisons referred to. In the discussion following the formal description of each species in the present paper reference is made merely to its nearest relative and the principal points of difference are pointed out.

Valeriana trichiata Killip, sp. nov.

Climbing herb; stem terete, glabrous, pilosulous at the nodes; leaves simple, oblong-ovate, 5 to 7 cm. long, 1.5 to 2 cm. wide, acute at both ends, sessile or the lower short-petioled, entire at margin, triplinerved, above glabrous, beneath glabrous or sparsely hirsute on the nerves, bright green when dry; bracts similar to the leaves, decreasing to about 1 cm. long, sessile; inflorescence paniculate, diffuse, about 25 cm. long, the branches glabrous or sparsely hirsutulous toward ends; bractlets oblanceolate, about 3 mm. long, acute, densely ciliate, otherwise glabrous, green throughout; corolla white, funnelform, 1.5 mm. long, 5-lobed, the lobes orbicular, 0.5 mm. long or less; fruit oblong-ovate, 3-nerved on one face, 1-nerved on other.

Type in the U. S. National Herbarium, no. 1, 143,768, collected in forest between Paletará and Calaguala, Department of El Cauca, Colombia, altitude 3000–3200 meters (Central Cordillera), June 17, 1922, by F. W. Pennell (no. 7103).

The densely ciliate bractlets distinguish this species from its near relative, *V. pavonii*, both belonging to the small group of scandent species.

Valeriana quindiensis Killip, sp. nov.

Shrubby vine; stem terete, woody below, herbaceous above, glabrous, pilosulous at the nodes, the internodes 1 cm. long, or less, below, longer upward; leaves ovate-oblong, 2.5 to 4 cm. long, 0.8 to 1.5 cm. wide, acute at apex, decurrent at base to a short (about 5 mm.) petiole, entire, subtriplinerved reticulate-veined (nerves and veins impressed above), dark green, sublustrous and glabrescent above, paler, dull, and scurfy-glandular beneath, often densely crowded on sterile axillary branches; inflorescence diffusely paniculate, twice-trichotomous, the branchlets repeatedly dichotomous, ferruginous-pilosulous; bractlets oblong-lanceolate, 2 to 3 mm. long, acutish; corolla turbinate-campanulate, barely 1 mm. long, 5-lobed, white or yellowish green; fruit lance-oblong, 3-nerved on one face, 1-nerved on other, thickened at margin, sparingly pilosulous, pappose, the pappus about 16-rayed.

Type in the U. S. National Herbarium, no. 1,191,839, collected on rocky cliff, Páramo del Quindio, Department of Caldas, Colombia, altitude 3800–4000 meters (Central Cordillera), August 15–20, 1922, by F. W. Pennell and

[2] Bot. Jahrb. Engler **3**: 38–44. 1882; Nat. Pflanzenfam. **4**[1]: 172–182. 1891.
[3] Bot. Jahrb. Engler **26**: 425–436. 1899; **37**: 464–480. 1906.
[4] Ann. Conserv. Jard. Bot. Genève **17**: 347–356. 1917.

T. E. Hazen (no. 10075). Two other specimens in the National Herbarium, from the Páramo de Ruiz, in the same general locality (*Pennell* 3084 and *Lehmann* 3164) belong to this species.

This species is related to *V. clematitis* H. B. K., *V. laurifolia* H. B. K., and *V. hispida* Turcz., Pennell's 10075 having been compared with the types of these three species in Europe. It differs from all of them in the closely crowded, proportionately narrower leaves which are densely scurfy-glandular beneath.

Valeriana tatamana Killip, sp. nov.

Erect herb, about 65 cm. high, thickened at base; stem simple, terete, shallowly grooved, glabrescent in lower half, finely pilosulous in upper; basal leaves lanceolate, 15 to 20 cm. long, 1.5 to 2 cm. wide, acute or slightly obtusish at apex, tapering to a broadly winged, retrorse-ciliate, sheathing petiole about 3.5 cm. long, 11 or 13-nerved (nerves prominent, with numerous cross-veins between the nerves), leathery-coriaceous, shining and dark green above, duller and olive-brown beneath, glabrous or finely pubescent on the midnerve above, sparsely ciliate at the subrevolute margin; cauline leaves about 4 pairs, lanceolate, 9 (decreasing to 2.5) cm. long, 1.5 to 1 cm. wide, cordulate at base, abruptly narrowed to a petiole 1 to 0.5 cm. long; inflorescence a contracted panicle about 12 cm. long, densely rufo-pilosulous, the terminal and axillary panicles twice or thrice-trichotomous, 3 to 5 cm. wide, the lowest panicles with well developed peduncles, the heads subglobose, about 1.5 cm. wide, densely flowered; bracts oblong, 7 to 8 mm. long, about 2 mm. wide, acutish, ciliate below, purplish throughout; bractlets lance-oblong, about 5 mm. long, 1.5 mm. wide, entire or with 2 small lobes just below apex, ciliate to apex, otherwise glabrous, purplish at center, pale at margin; corolla funnelform, about 1 mm. long, 5-lobed; stamens very slightly exserted.

Type in the U. S. National Herbarium, no. 1,143,788, collected on wet grassy páramo, Cerro Tatamá, Department of Caldas, Colombia, altitude 3400–3700 meters (Western Cordillera), September 8–10, 1922, by F. W. Pennell (no. 10582).

This is related to *V. plantaginea* and *V. longifolia*, differing from both in the glossy, acute, short-petioled, conspicuously nerved leaves and strongly ciliate bracts and bractlets. From *V. plantaginea* it is further distinguished by much smaller bracts, and from *V. longifolia* by a more contracted panicle with very densely flowered heads.

Valeriana asterothrix Killip, sp. nov.

Plant "1 to 1.5 cm.," straggling (or erect?); stem terete, densely short-hirsute, leafy to inflorescence, the upper leaves remote; leaves cordate, 3 to 6 cm. long, 1.5 to 3.5 cm. wide (upper leaves and those of sterile branches smaller), acute at apex, petiolate (petioles up to 2 cm. long, the upper leaves subsessile), dentate or crenate-dentate, short-hirsutulous above, densely stellate-pubescent beneath especially on the nerves; bracts oblong-lanceolate, 6 to 8 mm. long, 2 to 3 mm. wide, obtuse, subentire, free to base; inflorescence a contracted trichotomous cyme about 3 cm. wide (in flower); bractlets linear or slightly linear-spatulate, about 5 mm. long, obtuse, conspicuously 1-nerved, minutely ciliate; corolla white, funnelform, the tube 4 to 5 mm. long, the lobes ovate-oblong, 1.5 to 2 mm. long, rounded; stamens exserted; fruit lance-oblong, about 4 mm. long, 3-nerved on one face, 1-nerved on other, glabrous, apparently epappose.

Type in the U. S. National Herbarium, no. 1,196,436, collected in rich woods between Oña and Cuenca, Province Assuay, Ecuador, altitude 2700–3300 meters, September 10, 1923, by A. S. Hitchcock (no. 21629).

This plant very closely resembles the type specimen of *V. malvacea* Graebn., with which it was compared at Berlin. The leaves in both cases are quite similar and have the same characteristic stellate pubescence. In *V. asterothrix* the flowers are fully three times as large as in *V. malvacea*, the fruit is much larger, the inflorescence more contracted, the leaves more coarsely toothed, and the pubescence of the stem much different.

Valeriana renifolia Killip, sp. nov.

Erect, perennial (?) herb, about 65 cm. high; roots elongate, fleshy, up to 5 mm. thick; stems striate, straw-colored, pilose with whitish hairs below, glabrescent above, densely pilosulous at nodes; basal leaves subreniform or broadly ovate, 1.5 to 3.5 cm. long, 2.5 to 3 cm. wide, rounded at apex, coarsely, and often doubly crenate-dentate or repand-dentate, 5-nerved at base, petiolate (petioles 2.5 to 3 cm. long), glabrescent or sparsely subappressed-pilose, rather fleshy; cauline leaves oblong or lanceolate-oblong, about 1.5 cm. long 0.6 to 0.8 cm. wide (lower leaves), 1 to 0.5 cm. long (upper leaves), sessile, subamplexicaul, irregularly glandular-denticulate; inflorescence paniculate, up to 20 cm. long, 15 cm. wide, the primary branches 2 to 4 at a node, 5 to 7-dichotomous, the flowers borne singly but approximately at the ends of the ultimate branches; bracts linear, 5 mm. long or less, acute; bractlets linear, up to 2 mm. long, mucronulate, hyaline, with dark midrib; flowers very small, funnelform, 1 to 1.5 mm. long, 5-lobed, the lobes orbicular; fruit ovate, 1 mm. long, nerveless, pappose, the pappus about 8-rayed.

Type in the herbarium of the Field Museum of Natural History, no. 534169, collected on rock ledges, Huariaca, Peru, altitude 2900 meters, April 3, 1923, by J. F. Macbride (no. 3099).

The relationship of this new species is with *V. baltana* Graebn., the type of which I examined at Berlin. *Valeriana baltana*, however, is leafy up to the inflorescence, the cauline leaves being only slightly narrower than the basal; the panicle is much larger; and the fruit is twice as long as in *V. renifolia*, and more oblong in shape.

Valeriana melanocarpa Killip, sp. nov.

Erect herb, 40 cm. high or more; stem subterete, pilosulous or glabrescent; leaves (only upper cauline seen) up to 8 cm. long, unequally pinnate, subsessile, the leaflets ovate-oblong or ovate-lanceolate, acute, shallowly repand-dentate or nearly entire, finely appressed-pubescent above, white-tomentose beneath, membranous, the terminal leaflet 4 to 5.5 cm. long, acutish at base, the lateral leaflets two pairs (upper pair 2.5 to 3.5 cm. long, about 1 cm. wide, the lower pair about 1 cm. long, 0.6 to 0.8 cm. wide), oblique at base, decurrent; inflorescence cymose-paniculate, terminal and in the axils of the upper leaves, the cymes rather compact, the branches arcuate-ascending, up to 10 cm. long, trichotomous, the branchlets repeatedly dichotomous, the flowers borne in clusters of 3 to 7 at the ends of the branchlets; bracts linear, up to 7 mm. long, pilosulous; bractlets linear-oblong, 2 mm. long, mucronulate, ciliate; fruit oblong-lanceolate, about 2 mm. long, 3-nerved on one face, 1-nerved on other, appressed-pilosulous, black, pappose, the pappus about 10-rayed.

Type in the U. S. National Herbarium, no. 604495, collected in the Lucumayo Valley, Peru, altitude 1800-3600 meters, June 18, 1915, by O. F. Cook and G. B. Gilbert (no. 1311).

The dense long-peduncled cymes and black fruit distinguish this species from its nearest relative *V. decussata* R. & P.

Valeriana macbridei Killip, sp. nov.

Plant herbaceous, 60 cm. high or more, woody at base, pilose or pilosulous throughout, the stem slender (about 5 mm. in diameter), terete, shallowly grooved; basal leaves crowded, up to 20 cm. long (including petiole), unequally pinnate (or those of the sterile shoots occasionally simple), the leaflets obtuse at apex, entire or remotely denticulate, subcarnulose, the terminal leaflet much larger than the lateral leaflets, ovate-cordate, 6 to 10 cm. long, 4 to 7 cm. wide, the lateral leaflets 2 pairs, ovate, 1.5 to 4 cm. long, 1 to 2.5 cm. wide (decreasing in size toward leaf base), sessile or subsessile, rounded and often oblique at base; cauline leaves similar to basal, decreasing to about 2 cm. long; inflorescence diffusely paniculate, up to 40 cm. long, twice-trichotomous, the branches dichotomous, the flowers borne singly or in two's and three's; bracts and bractlets linear, acute; corolla cylindric-funnelform, about 1.5 mm. long, 5-lobed; fruit narrowly oblong, about 2 mm. long, 3-nerved and glabrous on one face, 1-nerved and minutely pilosulous on other.

Type in the herbarium of the Field Museum of Natural History, no. 534750, collected on steep grass-shrub hillside, Piedra Grande, near Santo Domingo River, Peru, altitude 1500 meters, May 14–19, 1923, by J. F. Macbride (no. 3686). Duplicate in the U. S. National Herbarium.

Related to *V. paniculata* R. & P., this species is differentiated by obtuse leaflets and particularly by the much larger, ovate-cordate terminal leaflet.

A second collection from the same general locality (*Macbride* 4240) probably belongs to this species. Some of the leaves are fully 30 cm. long, with terminal leaflets up to 14 cm. long.

Valeriana hirsutissima Killip, sp. nov.

Plant herbaceous, with rootstock, tuberous-thickened at base, densely hirsute-pilose or the inflorescence and upper leaves glabrescent; leaves of sterile shoots simple, ovate-oblong, up to 2.5 cm. long, slender-petioled; basal and cauline leaves unequally pinnate, up to 25 cm. long (including petiole), the leaflets acuminate, glandular-serrulate, subcarnose, the lateral leaflets 2 to 5 pairs, up to 5 cm. long, 2 cm. wide, acutish and usually oblique at base, sessile or subsessile, the terminal leaflet ovate or ovate-oblong, up to 8 cm. long, 3.5 cm. wide, rounded or acutish at base; inflorescence diffusely paniculate, up to 40 cm. long, the branches divaricate, trichotomous, the branchlets dichotomous, the flowers distichous along the ultimate branchlets; bracts and bractlets linear, acute, mucronulate; corolla globose-campanulate, about 1 mm. long, 5-lobed, the lobes ovate; fruit oblong, about 2 mm. long, 3-nerved on one face, 1-nerved on other, pilosulous, pappose.

Type in the herbarium of the Field Museum of Natural History, no. 536168, collected on open brushy hills, Pampayacu, at mouth of Chinchao River, Peru, altitude 1000 meters, July 19–25, 1923, by J. F. Macbride (no. 5118). Duplicate in the U. S. National Herbarium.

This species also is similar to *V. paniculata* R. & P. in leaf shape and general habit. The distichous arrangement of the flowers on the branches, more like that of *V. urticaefolia*, at once distinguishes the species from *V. paniculata*. In addition, the lower leaves are strongly hirsute.

Valeriana bambusicaulis Killip, sp. nov.

Plant herbaceous, about 3 meters high, woody at base, the roots fibrillose; stem stout, up to 2 cm. thick, terete, glabrous, smooth or finely striate or shallowly grooved; leaves of sterile shoots simple, ovate, 2 to 5 cm. long, 1 to 3 cm. wide, long-petioled, the petioles slender, up to 7 cm. long; basal leaves unequally pinnate, up to 25 cm. long (probably longer), the petioles quadrangular, glabrous, dilated at base, the rachis quadrangular, finely pubescent above, the lateral leaflets 4 or 5 pairs, the terminal and lateral leaflets subequal, oblong or oblong-lanceolate, up to 6 cm. long, 3 cm. wide, acute at apex, rounded or acutish at base, petiolulate (petiolules up to 1 cm. long), entire at margin, finely puberulent or glabrescent, subcoriaceous, dark green above, paler beneath; cauline leaves linear-lanceolate, simple, 2 to 4 cm. long, acuminate, entire or glandular-serrulate toward apex; inflorescence diffusely paniculate, the branches divaricate or arcuate-ascending, 4 or 5 times trichotomous, the flowers 1 to 4 at the ends of the branchlets; bractlets linear-lanceolate, about 2 mm. long, acute; corolla globose-campanulate, 1 mm. long, 5-lobed, the lobes orbicular-ovate; fruit oblong-lanceolate, about 2 mm. long, usually curved, 3-nerved on one face, 1-nerved on other, glabrous,pappose, the pappus about 6-rayed.

Type in the herbarium of the Field Museum of Natural History, no. 535549, collected on a wet shrubby slope, Tambo de Vaca, Peru, altitude 3800 meters, June 10–24, 1923, by J. F. Macbride (no. 4463). Duplicate in the U. S. National Herbarium.

This species is related to *V. warburgii* Graebn. It differs in its much thicker, entire, proportionately longer leaflets.

Valeriana tenella Killip, sp. nov.

Slender herb, about 30 cm. high; roots tuberous; stem subquadrangular, glabrous or sparingly pilosulous, the internodes 2 to 4 cm. long; basal leaves not present on type specimen; cauline leaves up to 3 cm. long, unequally pinnate (terminal leaflet subrhombic, up to 1 cm. long, 0.6 cm. wide; lateral leaflets 1 or 2 pairs, oblong-lanceolate, smaller), the leaflets acuminate, sessile or subsessile, irregularly glandular-serrate, finely pubescent on nerves, membranous; flowers in trichotomous cymes 1 cm. wide or less, borne on filiform peduncles (up to 1.5 cm. long) in the axils of the much reduced upper leaves; bracts linear, 1.5 cm. long; bractlets linear-spatulate, 1 mm. long or less; corolla cylindric-campanulate, about 1 mm. long, white, the 5 lobes green.

Type in the U. S. National Herbarium, no. 1,118,526, collected at Palmira, Mérida, Venezuela, altitude 2100 meters, September 1, 1921, by A. Jahn (no. 564).

Comparison of this specimen with the type of *V. sorbifolia* H. B. K. in the Humboldt Herbarium, Paris, shows a close relationship between the two species. *Valeriana tenella*, however, is a much more slender plant, with one or two, not five or six, pairs of lateral leaflets. The leaflets are more finely toothed, and are pubescent on the under side of the nerves.

A plant in the herbarium of the Jardin Botanique, Geneva, collected by Brother Apollinaire near Bogotá, Colombia, is probably this new species.

Valeriana isoetifolia Killip, sp. nov.

Plant perennial, cespitose, the caudex about 5 mm. thick, woody, branched above, basal leaves rosulate, numerous, narrowly linear, 1.5 to 2.5 cm. long, up or 2 mm. wide, acute, sessile, dilated to a sheathing base, scabrous at margin, 3 or 5-nerved, fleshy, russet brown or blackish when dry; scapes up to 11 cm. long, finely pubescent, bearing at or above the middle a cluster of three leaves similar to the basal leaves; bracts linear, about 7 mm. long, 2 mm. wide, 1-nerved, hyaline at margin; inflorescence a dense, subglobose or broadly ovoid head 1 to 1.5 cm. in diameter; bractlets spatulate, 3 to 4 mm. long, truncate and submarginate at apex, purplish at center, pale at margin; corolla cylindric-campanulate, about 3 mm. long, white, 5-lobed, the lobes ovate; fruit 2.5 mm. long, 1-nerved, glabrous, pappose, the pappus 6-rayed, white.

Type in the herbarium of the Field Museum of Natural History, no. 535510, collected among rocks at the summit of range, near Tambo de Vaca, Peru, altitude 4000 meters, June 10–24, 1923, by J. F. Macbride (no. 4424). Duplicate in the U. S. National Herbarium.

Apparently this species is nearest *V. romanana* Graebn. The scapes are much longer, the flowers are borne in a single larger, globose head, the leaves are acute, not rounded at apex, and the caudex is much branched.

Valeriana ligulifolia Killip, sp. nov.

Plant acaulescent, from a slender taproot, the crown bearing numerous persistent enlarged bases of leaves; leaves narrowly linear-spatulate, 9 to 10 cm. long, 3 to 4 mm. wide toward apex, about 2 mm. wide below middle, abruptly enlarging to a sessile base about 10 mm. wide, obtuse, conspicuously 3-nerved, fleshy, glabrous, bright green when dry; peduncles subequal to the leaves and of similar texture, the flowers borne in a single dense terminal head; bracts lanceolate or ovate-lanceolate, unequal, 5 to 8 mm. long, 4 to 5 mm. wide at the connate base, acutish, minutely ciliate; bractlets linear, 2 to 3 mm. long, obtuse; flowers not developed in type specimen.

Type in the U. S. National Herbarium, no. 1,143,789, collected on wet, grassy páramo, Cerro Tatamá, Department of Caldas, Colombia, altitude 3400–3700 meters (Western Cordillera), September 8–10, 1922, by F. W. Pennell (no. 10583).

This species belongs to the small group, perhaps generically distinct from *Valeriana*, in which the plants are acaulescent and the bracts connate, of which the best-known Colombian species is *V. bracteata* Benth. From that *V. ligulifolia* is distinguished by longer, more slender, 3-nerved (not 5 or 7-nerved) leaves, and ciliate bracts.

BOTANY.—*New plants from Central America.—IV.*[1] PAUL C. STANDLEY, U. S. National Museum.[2]

In this paper there appear descriptions of several new species of Panama plants, and Dr. William Trelease has contributed an account of a new species of *Peperomia* collected in Guanacaste, Costa Rica, by Prof. Juvenal Valerio. The rather numerous new combinations listed below are mostly ones necessary for the proper listing of the flora of the Canal Zone.

Cyperus hayesii (C. B. Clarke) Standl.

Torulinium hayesii C. B. Clarke, Kew Bull. Add. Ser. **8**: 20. 1908.

Cyperus panamensis (C. B. Clarke) Britton.

Mariscus panamensis C. B. Clarke, Kew Bull. Add. Ser. **8**: 15. 1908.

Stenophyllus hirtellus (Schrad.) Standl.

Isolepis hirtella Schrad. in Schult. Mant. **2**: 70. 1824.

Callisia multiflora (Mart. & Gal.) Standl.

Commelina multiflora Mart. & Gal. Bull. Acad. Brux. **9**[2]: 374. 1842.
Callisia martensiana C. B. Clarke in DC. Mongr. Phan. **3**: 312. 1881.

Vagnera paniculata (Mart. & Gal.) Standl.

Smilacina paniculata Mart. & Gal. Bull. Acad. Brux. **9**[2]: 388. 1842.

Vagnera salvini (Baker) Standl.

Tovaria salvini Baker, Journ. Linn. Soc. Bot. **14**: 567. 1875.

Vagnera flexuosa (Bertol.) Standl.

Smilacina flexuosa Bertol. Nov. Com. Acad. Bonon. **4**: 411. *pl.* **39**. 1840.

Vellozia panamensis Standl., sp. nov.

Caudex simple or branched, densely covered by the persistent fibrous leaf bases; leaves linear, 8–25 cm. long, 5–9 mm. wide, subulate-attenuate, glabrous above, whitish-pilose beneath, the margins cartilaginous, smooth; scapes 1 or 2, stout, 4–6 cm. high, densely glandular, the glands short-stipitate above; perianth tube nearly 5 cm. long, densely covered with stipitate glands, the lobes linear, about 1 cm. long, glandular outside, stamens 12; style filiform, twisted above, exceeding the perianth; capsule 1.5 cm. long, globose-oval, very densely covered with dark glands, these borne on stout spinelike stipes.

Type in the U. S. National Herbarium, no. 715574, collected on Cerro Vaca, eastern Chiriquí, Panama, altitude 900–1135 meters, by H. Pittier (no. 5352).

This is the first plant of its family (Velloziaceae) to be reported from Central America.

[1] See this JOURNAL **15**: 285–289. 1925.

[2] Published by permission of the Secretary of the Smithsonian Institution.

Peperomia valerioi Trelease, sp. nov.

A moderately small, stoloniferous, glabrous herb; stem short but rather thick (5–6 mm.); leaves alternate, elliptic- or obovate-spatulate, obtuse, more or less emarginate, cuneately attenuate, rather large (4.5–5 × 11 cm.), drying coriaceous and rather glossy, pinnately veined nearly throughout, the branches of the midrib about 6 × 2; petiole short (about 1 cm.), scarcely winged; spikes terminal, moderately stout and long (2 × 100 mm. or more), closely flowered; peduncle about 8 cm. long, bracted at about the middle; bracts small, round-peltate, about 12 to the pseudo-whorl; berries oblong, the short conical beak filiformly protracted; stigma anterior at base of the beak.

Type in the U. S. National Herbarium, no. 1,169,888, collected at Arenal, Costa Rica, at 600 meters, by Juvenal Valerio (no. 31).

Struthanthus oerstedii (Oliver) Standl.

Loranthus oerstedii Oliver, Naturh. For. Kjöbenhavn Vid. Medd. **1864:** 171. 1865.

This new name has been listed by the writer (in Standl. & Calderón, Lista Pl. Salv. 72. 1925), but without indication of the name-bringing synonym.

Alternanthera williamsii Standl.

Achyranthes williamsii Standl. Contr. U. S. Nat. Herb. **18,** 89. 1916.

Alternanthera williamsii f. **purpurea** Standl., f. nov.

Like the typical form of the species, and differing only in the color of the leaves, which are purple or purple-red.

Type in the U. S. National Herbarium, no. 1,153,387, collected along the Corozal Road, near Panama City, Panama, Dec. 13, 1923, by Paul C. Standley (no. 26892).

Typical *A. williamsii* is a common weedy plant in thickets about the Canal Zone. This striking form, with handsomely colored leaves, is seen frequently in gardens, where it is planted for ornament. It occurs also in the wild state, but perhaps only as an escape from cultivation. The flowers are white, as in the normal form. When specimens are dried all the purple coloration disappears.

Castalia blanda (Meyer) Standl.

Nymphaea blanda Meyer, Prim. Fl. Esseq. 201. 1818.

Radicula mexicana (Moc. & Sessé) Standl.

Nasturtium mexicanum Moc. & Sessé; DC. Reg. Veg. Syst. **2:** 193. 1821.

Leptoglottis leptocarpa (DC.) Standl.

Schrankia leptocarpa DC. Prodr. **2:** 443. 1825.

Leptoglottis hamata (Humb. & Bonpl.) Standl.

Schrankia hamata Humb. & Bonpl.; Willd. Sp. Pl. **4:** 1042. 1805.

Leptoglottis DC. seems to be the proper name for the genus known as *Schrankia* Willd. and more recently as *Morongia* Britton.

Amerimnon escatophyllum (L.) Standl.

Hedysarum ecastophyllum L. Syst. Nat. ed. 10. 1169. 1759.

Machaerium microphyllum (Meyer) Standl.

Drepanocarpus microphyllus Meyer, Nov. Act. Nat. Cur. **12**: 808. 1825.
Machaerium glabripes Pittier, Contr. U. S. Nat. Herb. **20**: 472. 1922.

Protium sessiliflorum (Rose) Standl.

Icica sessiliflora Rose, N. Amer. Fl. **25**: 259. 1911.

Malache ovata (Presl) Standl.

Malachra ovata Presl. Rel. Haenk. **2**: 125. 1836.

Malache fruticosa (Mill.) Standl.

Sida fruticosa Mill. Gard. Dict. ed. 8. *Sida* no. 18. 1768.

Malache dasypetala (Turcz.) Standl.

Pavonia dasypetala Turcz. Bull. Soc. Nat. Moscou **31**: 189. 1858.

Taonabo seemanni (Triana & Planch.) Standl.

Ternstroemia seemanni Ann. Sci. Nat. IV. **18**: 260. 1862.

Parsonsia calophylla (Cham. & Schlecht.) Standl.

Cuphea calophylla Cham. & Schlecht. Linnaea **2**: 361. 1827.

Chelonanthus alatus (Aubl.) Standl.

Lisianthus alatus Aubl. Pl. Guian. 214. *pl. 80.* 1775.

Malouetia guatemalensis (Muell. Arg.) Standl.

Stemmadenia guatemalensis Muell. Arg. Linnaea **30**: 410. 1860.
Malouetia panamensis Heurck & Muell.; Heurck, Obs. Bot. 185. 1870.

Prestonia obovata Standl., sp. nov.

Large woody vine with milky sap, the branches bearing numerous corky tubercles; leaves opposite, the petioles stout, 7–14 mm. long; leaf blades obovate or broadly obovate, 10–16 cm. long, 5–7.5 cm. wide, cuneate at base, obtuse or rounded at apex and cuspidate-apiculate, thick, glabrous, green above, pale beneath, with about 9 pairs of lateral nerves; inflorescences terminal, racemose, pedunculate, the pedicels stout, 1–1.5 cm. long, puberulent; calyx sparsely puberulent or glabrate, thick and fleshy, the 5 lobes twice as long as the tube, lance-oblong, acuminate, the calyx bearing within at base 5 deltoid truncate scales 2 mm. long; ring of the disk cuplike, 2.5 mm. long; corolla salverform, glabrous, fleshy, the lobes yellow, the throat purplish, the tube 15 mm. long, 4–5 mm. thick, the lobes contorted, broadly oblique-ovate, nearly 1 cm. long, cuspidulate; corolla throat furnished with an annulus 2 mm. high; anthers sagittate, 5 mm. long, connivent about the stigma, appendaged at base.

Type in the U. S. National Herbarium, no. 678837, collected along trail between Gamboa and Cruces, Canal Zone, Panama, July 2, 1911, by H. Pittier (no. 3767).

Not closely related to any species known previously from Central America Sterile specimens from Gatuncillo, Canal Zone (*Piper* 5609, 5643) are probably referable to this species. The leaves of these specimens are as much as 25 cm. long and 15 cm. wide.

Prestonia exserta (A. DC.) Standl.

Haemadictyon exsertum A. DC. in DC. Prodr. **8**: 426. 1844.

This species was described from Caracas, Venezuela. It occurs also in Panama.

Cestrum panamense Standl., sp. nov.

Slender tree 4.5–9 meters high, the branchlets terete, green, glabrous or very sparsely puberulent; petioles slender, 7–15 mm. long, glabrous or nearly so; leaf blades mostly lance-oblong, sometimes ovate or ovate-oblong, 10–16 cm. long, 3.5–7 cm. wide, acuminate to long-attenuate at apex, rounded or broadly rounded at base, thin, bright green, glabrous, the lateral nerves about 15 on each side, arcuate-spreading; cymes axillary and terminal, lax, few or many-flowered, 2–6 cm. long, the branches very slender, slightly tomentulose or glabrate, the bracts linear or lanceolate, green, 10 mm. long or shorter, the flowers partly slender-pedicellate and partly sessile; calyx green, narrow-campanulate, 1.5–2 mm. long, glabrous or thinly and minutely tomentulose, the limb shallowly and irregularly 5-dentate, the teeth obtuse; corolla pale green, the tube slender, glabrous outside, 10–11 mm. long, gradually widening from base to apex, nearly 2 mm. wide at the mouth, the 5 lobes oblong-lanceolate, 3 mm. long, obtuse or acutish, pubescent outside along the incurved margins; filaments inserted 2.5 mm. below the apex of the corolla tube, the filaments glabrous, not appendaged; style equaling the corolla tube; fruit subglobose, glabrous, 6 mm. in diameter.

Type in the U. S. National Herbarium, no. 1,217,919, collected in moist forest along the Río Tapia, Province of Panama, Panama, near sea level, Dec. 24, 1923, by Paul C. Standley (no. 28042). The following collections also represent the species:

PANAMA: Hills west of Canal near Gatún, Canal Zone, *Standley* 27261. Río Tapia, *Standley* 30661. Along Río Dupí, eastern Chiriquí, *Pittier* 5238.

COSTA RICA: Forests of Boca de Zhorquín, Talamanca, alt. 50 m., *Tonduz* 8568. Forests of Tuis, alt. 600 m., *Tonduz* 11355.

HONDURAS: Cuyamel, *Carleton* 460.

Bacopa limosa (Pennell) Standl.

Macuillamia limosa Pennell, Proc. Acad. Phila. **1920**: 158. 1920.

Bacopa violacea (Pennell) Standl.

Monocardia violacea Pennell, Proc. Acad. Phila. **1920**: 156. 1920.

Bacopa humilis (Pennell) Standl.

Monocardia humilis Pennell, Proc. Acad. Phila. **1920**: 157. 1920.

Bacopa axillaris (Benth.) Standl.

Herpestis axillaris Benth. in DC. Prodr. **10**: 396. 1846.

Arrabidaea isthmica Standl., sp. nov.

Large woody vine, the branchlets terete, brown, puberulent or glabrate; petioles 2.5–3 cm. long, the petiolules 1.5–2 cm. long; tendrils long, slender, simple, coiled; leaflets 2, lance-oblong, 12–15 cm. long, 5–5.5 cm. wide, rounded and emarginate at base, acuminate at apex, thin, nearly concolorous, minutely puberulent above along the costa, obscurely puberulent beneath along the nerves or nearly glabrous, the venation prominent-reticulate; panicles axillary, 30 cm. long, laxly many-flowered, ovoid, the branches densely puberulent; calyx campanulate, 5 mm. long, densely and minutely puberulent, the limb truncate, with 5 minute distant teeth; corolla pink, 5.5–6 cm. long, finely tomentose outside, the tube about 7 mm. long and 4 mm. thick, abruptly expanding into the throat, this 1.5–2 cm. wide at the mouth, the lobes broadly rounded; stamens subequal, the anthers 2 mm. long; ovary elongate-ovoid, minutely lepidote.

Type in the U. S. National Herbarium, no. 676736, collected near Paraíso, Canal Zone, Panama, Jan. 26, 1911, by H. Pittier (no. 2576).

Anemopaegma punctulatum Pitt. & Standl., sp. nov.

Large woody vine, the branchlets slender, terete at first, angulate in age, glabrous; leaves opposite, 2-foliolate, bearing in their axils sessile suborbicular green foliaceous appendages 5–8 mm. long; petioles 1–2.5 cm. long, the petiolules 4–8 mm. long; leaflets elliptic-oblong, 8.5–13.5 cm. long, 3–5 cm. wide, acute or obtuse at base, acute or acuminate at apex, with obtuse tip, thin-coriaceous, glabrous, concolorous, puncticulate, especially beneath; tendrils, when present, very long, slender, simple; flowers geminate or ternate in the axils, on pedicels 1–1.5 cm. long; calyx campanulate, 9–13 mm. long, 9 mm. wide, glabrous, punctate, the margin entire; corolla pale yellow, the tube 6–7 cm. long, slender below, gradually dilated about 2 cm. above the base into a throat 1.5–2 cm. broad, the lobes subequal, broadly rounded, 1.5 cm. long, densely and minutely lepidote within.

Type in the U. S. National Herbarium, no. 1,083,010, collected along the Río Sirrí, Trinidad Basin, Province of Colón, Panama, near sea level, July, 1911, by H. Pittier (no. 4009). The following collections also belong here:

PANAMA: Near Gatún, Canal Zone, *Goldman* 1869. Caño Quebrado, Canal Zone, *Pittier* 6669.

COSTA RICA: Limón, *Pittier*, 16005.

Related species are *A. grandiflorum* Sprague, in which the leaflets are much broader and the flowers larger, and *A. chaimberlaynii* (Sims) Bur. & Schum., which has much smaller flowers.

Guarania suberosa Standl., sp. nov.

Large woody vine, climbing over tall trees, the stems 1.5–3 cm. thick, covered with very thick, narrow, corky ridges, the wood divided into radial sections, with numerous large longitudinal channels; staminate racemes clustered on short spurs on naked stems near the ground; peduncles 1–3.5 cm. long, sparsely hirtellous or glabrate; rachis about 1 cm. long, the pedicels numerous and dense, 1–3 cm. long, minutely appressed-pubescent or glabrate; calyx tube 2–2.5 cm. long, orange-scarlet, minutely puberulent or glabrate, swollen at base, above about 3 mm. thick; sepals narrowly linear, 5–10 mm. long, orange-red, spreading; petals linear-attenuate, yellow, 3–4 mm. long, connivent to form a sharp-pointed cone; stamens 2, dorsifixed, 12–14 mm. long, linear, short-replicate at base, the connective linear, prolonged at apex as a linear-triangular papillose appendage.

Type in the U. S. National Herbarium, no. 1,219,834, collected in moist forest on Barro Colorado Island in Gatún Lake, Canal Zone, Panama, near sea level, Jan. 17, 1924, by Paul C. Standley (no. 31461). Also collected in forest along the Río Indio de Gatún, Canal Zone, Jan. 1911, by E. A. Goldman (no. 2778).

The leaves of this species have not been collected. Species of *Guarania* with woody stems are rare, and habitally (as well as structurally) this one seems to resemble *G. megistantha* Donn. Smith, described from the Atlantic lowlands of Costa Rica. In that species, however, the petals are longer than the sepals.

ZOOLOGY.—*New species and subspecies of American turtles.* LEONHARD STEJNEGER, U. S. National Museum.

It has been considered advisable to place on record the following brief characterizations of some undescribed forms of turtles in the collection of the U. S. National Museum.

Kinosternon herrerai, new species.

Diagnosis.—Plastron smaller than opening of shell; plastron deeply incised posteriorly; carapace without keel; nasal shield furcate; width of bridge contained in the length of the anterior plastral lobe; postcentrals scarcely lower than tenth marginals; interpectoral seam one-fourth to one-third the interhumeral; gular relatively short, shorter than one-half the anterior lobe; interabdominal seam shorter than either lobe; first central lamina narrow, widely separated from second marginals; rostrum strongly hooked; male with postfemoral tuberculated patches.

Type.—U. S. National Museum No. 61249. Adult male.

Type locality.—Xochimilco, Valley of Mexico.

In addition to the type three adult females were presented to the National Museum by Dr. Alfonso L. Herrera, the distinguished director of Biological Studies, and the National Museum of Mexico, through Dr. A. Busck.

The new species, although larger and with a larger head, has the general appearance of *K. subrubrum*, but it differs in many important respects, as shown in the diagnosis. References in the literature to *K. pensilvanicum* in Mexico in most instances relate to the present species.

Kinosternon abaxillare Baur, new species.

Diagnosis.—"Near *Kinosternon cruentatum*, but axillary lamina absent and posterior seam of abdominal laminæ convex; three more or less distinct longitudinal keels near together; plastron not emarginate behind; gular large, about one-half the length of anterior lobe; interfemoral seam very short, at most one-sixth of interanal seam."

Type.—U. S. National Museum No. 7518; adult male.

Type locality.—Tuxtla, Chiapas, Mexico.

In the national collection there are twelve shells collected by Dr. C. H. Berendt at Tuxtla. They were named *Kinosternon abaxillare* by the late Dr. Georg Baur, from whose manuscript note I have abstracted the above diagnosis. The locality Tuxtla, visited by Dr. Berendt, is Tuxtla Gutierrez, not far from the Chiapas River, which belongs to the Atlantic watershed and

drains into the Gulf of Mexico. It should not be confounded with Tuxtla in the state of Verz Cruz. The species seems to be a valid one, though the most obvious character, the absence of a distinct axillary, is not absolutely constant, inasmuch as in a young specimen it is plainly separated off from the abdominal lamina by a distinct seam.

Kinosternon bauri palmarum, new subspecies.

Diagnosis.—Differs from typical *Kinosternon bauri* in the head being larger and the snout less conical and pointed; profile of beak more perpendicular; horizontal outline of carapace more perfectly elliptical; laminae of carapace thin, semitranslucent, pale; color of head including nasal shield, pale gray with a uniform reticulation of dusky lines and spots; temporal pale stripes more or less distinctly indicated.

Type.—U. S. National Museum No. 61065; adult female.

Type locality.—Royal Palm State Park, Dade County, Florida.

Three more specimens of this form, all collected at the same locality by C. A. Mosier, have been examined. They differ strikingly from the typical dark *K. bauri* by the thinness and translucency of the horny laminae of the upper surface, which results in the very pale color with the sutures of the bony shell underneath shining through as narrow whitish lines. As a consequence, the three longitudinal light bands on the carapace, so characteristic of the species, are rather indistinct. It should be noted that the coloration of the plastron is the normal one of the typical form.

Terrapene nelsoni, new species.

Diagnosis.—Nostrils vertically oval, close together, not visible in side view of head; hind feet with four claws; three phalanges in middle digit of fore foot; carapace with a median keel anteriorly; digits scarcely webbed; no bony temporal arch; upper jaw hooked, not notched in the middle; first marginal lamina almost as long as width of first central lamina; length of first central equals width of third central; fourth central shorter than width, shorter than first.

Type.—U. S. National Museum No. 46252; adult.

Type locality.—Pedro Pablo, Tepic, Mexico; 2500 feet altitude.

The type is unique and is one of two specimens of box turtles, the only ones obtained by Dr. E. W. Nelson and E. A. Goldman during their many years of collecting in Mexico. It is dedicated to Dr. E. W. Nelson, Chief of the U. S. Biological Survey, in recognition of the splendid work done by him and his organization in making known the vertebrate fauna of that country.

Graptemys pseudogeographica versa, new subspecies.

Diagnosis.—Color pattern of postocular region that of typical *Graptemys pseudogeographica*, fine light lines running obliquely upwards from tympanum to posterior edge of orbit, but postorbital spot extending backwards from its lower (outer) edge and not from its upper (inner) edge.

Type.—U. S. National Museum No. 27473.

Type locality.—Austin, Texas.

Seven paratypes from the same locality (U. S. N. M. Nos. 27474–80) are essentially like the type and differ markedly both from typical *pseudogeographica* and from *kohnii*.

SCIENTIFIC NOTES AND NEWS

DR. G. N. VORONOFF, head of the Russian Scientific Expedition to South America, spent several days in Washington recently. After a short tour through this country the party will proceed by way of Mexico and Cuba to the north coast of Colombia. For the present, botanical exploration will be confined chiefly to the mountainous region of eastern Colombia.

NEIL M. JUDD, curator of American Archeology at the National Museum, and director of the National Geographic Society's Pueblo Bonito Expedition, returned to Washington from New Mexico October 23. The fifth season of exploration in Pueblo Bonito, a prehistoric Indian village in northwestern New Mexico, was perhaps the most important of the entire expedition, resulting in the solution of several important problems. For the first time a definite pottery sequence—the cultural yardstick for all archeological research in the New World—has been established, and, as a result, the period during which Pueblo Bonito was occupied has been greatly extended. Geophysical, geological, and botanical studies have explained away many of the mysteries of Chaco Canyon and led to a better understanding of conditions as they must have existed there in prehistoric times. It is not improbable that a sixth season will be authorized in order to bring the Pueblo Bonito explorations to conclusion.

PAUL C. STANDLEY, of the National Museum, left recently for Costa Rica to carry on botanical exploration in that country, in connection with his studies of the flora of Central America.

E. C. LEONARD, of the National Museum, sailed November 6 for Haiti to make botanical collections for the Museum. This expedition is one of several that have been made possible through the coöperation of Dr. W. L. Abbott of Philadelphia, with the Smithsonian Institution.

BANTAM